5-13-1976

# Test 1211: Case M-B 4/94 Diesel (UNIMOG)

Tractor Museum
*University of Nebraska-Lincoln*, TractorMuseumArchives@unl.edu

# NEBRASKA TRACTOR TEST 1211 – CASE M-B 4/94 DIESEL (UNIMOG 406)

## POWER TAKE-OFF PERFORMANCE

| Hp | Crank-shaft speed rpm | Fuel Consumption Gal per hr | Fuel Consumption Lb per hp-hr | Hp-hr per gal | Temperature Degrees F Cooling medium | Temperature Degrees F Air wet bulb | Temperature Degrees F Air dry bulb | Barometer inches of Mercury |
|---|---|---|---|---|---|---|---|---|
| **MAXIMUM POWER AND FUEL CONSUMPTION** | | | | | | | | |
| **Rated Engine Speed—Two Hours (PTO Speed—1132 rpm)** | | | | | | | | |
| 73.33 | 2550 | 5.187 | 0.490 | 14.14 | 207 | 57 | 75 | 29.030 |
| **Standard Power Take-off Speed (540 rpm)—One Hour** | | | | | | | | |
| 69.65 | 2221 | 4.580 | 0.456 | 15.21 | 205 | 57 | 76 | 28.990 |
| **Standard Power Take-off Speed (1000 rpm)—One Hour** | | | | | | | | |
| 70.17 | 2253 | 4.638 | 0.458 | 15.13 | 208 | 56 | 75 | 29.020 |
| **VARYING POWER AND FUEL CONSUMPTION—Two Hours** | | | | | | | | |
| 63.42 | 2599 | 4.716 | 0.516 | 13.45 | 196 | 57 | 77 | ..... |
| 0.00 | 2705 | 2.068 | ..... | ..... | 178 | 58 | 78 | ..... |
| 32.25 | 2630 | 3.262 | 0.701 | 9.89 | 182 | 57 | 78 | ..... |
| 74.12 | 2550 | 5.239 | 0.490 | 14.15 | 203 | 57 | 78 | ..... |
| 16.38 | 2671 | 2.687 | 1.137 | 6.10 | 179 | 58 | 78 | ..... |
| 47.84 | 2618 | 3.933 | 0.570 | 12.17 | 184 | 58 | 78 | ..... |
| **Av 39.00** | **2629** | **3.651** | **0.649** | **10.68** | **187** | **57** | **77** | ..... |

## DRAWBAR PERFORMANCE

| Hp | Draw-bar pull lbs | Speed miles per hr | Crank-shaft speed rpm | Slip of drivers % | Fuel Consumption Gal per hr | Fuel Consumption Lb per hp-hr | Hp-hr per gal | Temp Degrees F Cool-ing med | Temp Degrees F Air wet bulb | Temp Degrees F Air dry bulb | Barometer inches of Mercury |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST** | | | | | | | | | | | |
| **Maximum Available Power—Two Hours 4th (D-2) Gear** | | | | | | | | | | | |
| 64.01 | 4508 | 5.33 | 2550 | 3.37 | 5.102 | 0.553 | 12.55 | 209 | 70 | 86 | 28.830 |
| **75% of Pull at Maximum Power—Ten Hours 4th (D-2) Gear** | | | | | | | | | | | |
| 51.67 | 3513 | 5.52 | 2618 | 2.48 | 4.435 | 0.595 | 11.65 | 189 | 69 | 80 | 28.851 |
| **50% of Pull at Maximum Power—Two Hours 4th (D-2) Gear** | | | | | | | | | | | |
| 34.55 | 2303 | 5.63 | 2650 | 1.71 | 3.641 | 0.731 | 9.49 | 180 | 60 | 68 | 28.850 |
| **50% of Pull at Reduced Engine Speed—Two Hours 5th (L-3) Gear** | | | | | | | | | | | |
| 34.86 | 2326 | 5.62 | 1879 | 1.59 | 2.704 | 0.538 | 12.89 | 181 | 69 | 81 | 28.860 |
| **MAXIMUM POWER WITH BALLAST** | | | | | | | | | | | |
| 58.69 | 10558 | 2.08 | 2549 | 13.22 | 1st (L-1) Gear | | | 196 | 70 | 86 | 28.810 |
| 64.19 | 8618 | 2.79 | 2551 | 8.31 | 2nd (D-1) Gear | | | 209 | 66 | 86 | 28.750 |
| 64.51 | 5802 | 4.16 | 2551 | 4.42 | 3rd (L-2) Gear | | | 208 | 67 | 86 | 28.770 |
| 66.33 | 4670 | 5.33 | 2551 | 3.37 | 4th (D-2) Gear | | | 210 | 67 | 85 | 28.770 |
| 65.70 | 3248 | 7.59 | 2550 | 2.24 | 5th (L-3) Gear | | | 206 | 67 | 86 | 28.770 |
| 65.61 | 2546 | 9.67 | 2550 | 1.61 | 6th (D-3) Gear | | | 205 | 67 | 86 | 28.770 |

**VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST**
**4th (D-2) Gear**

| | | | | | | |
|---|---|---|---|---|---|---|
| Pounds Pull | 4670 | 4922 | 5111 | 5368 | 5400 | 5132 |
| Horsepower | 66.33 | 62.72 | 57.74 | 52.87 | 45.56 | 36.30 |
| Crankshaft Speed rpm | 2551 | 2295 | 2037 | 1781 | 1525 | 1276 |
| Miles Per Hour | 5.33 | 4.78 | 4.24 | 3.69 | 3.16 | 2.65 |
| Slip of Drivers % | 3.37 | 3.60 | 3.60 | 3.97 | 3.97 | 3.78 |

| TRACTOR SOUND LEVEL WITH CAB | dB(A) |
|---|---|
| Maximum Available Power 2 Hours | 86.5 |
| 75% of Pull at Max. Power 10 Hours | 86.0 |
| 50% of Pull at Max. Power 2 Hours | 88.0 |
| 50% of Pull at Reduced Engine Speed 2 Hours | 82.5 |
| Bystander in 8th (D-4) Gear | 85.5 |

| TIRES, BALLAST AND WEIGHT | | With Ballast | Without Ballast |
|---|---|---|---|
| **Rear Tires** | —No., size, ply & psi | Two 12.5-20; 10; 36 | Two 12.5-20; 10; 36 |
| Ballast | —Liquid | None | None |
| | Cast Iron (on platform) | 3860 lb total | None |
| **Front Tires** | —No., size, ply & psi | Two 12.5-20; 10; 36 | Two 12.5-20; 10; 36 |
| Ballast | —Liquid | None | None |
| | Cast Iron (on bumper) | 760 lb total | None |
| **Height of drawbar** | | 33.0 inches | 33.0 inches |
| **Static weight with operator**—rear | | 6050 lb | 3230 lb |
| | front | 7060 lb | 5260 lb |
| | total | 13110 lb | 8490 lb |

**Department of Agricultural Engineering**

**Dates of Test:** May 13 to 21, 1976

**Manufacturer:** DAIMLER-BENZ A.G., STUTTGART, GERMANY

**FUEL, OIL AND TIME** **Fuel** No 2 Diesel **Cetane No** 51.7 (rating taken from oil company's typical inspection data) **Specific gravity converted to 60°/60°** 0.8328 **Weight per gallon** 6.934 lb **API service classification** SB/SE CA/CD **To motor** 4.206 gal **Drained from motor** 3.501 gal **Transmission and final drive lubricant** SAE 80 **Total time engine was operated** 50 hours.

**ENGINE** **Make** Daimler-Benz Diesel **Type** 6 cylinder vertical **Serial No** 353.902-10-380157 **Crankshaft mounted** lengthwise **Rated rpm** 2550 **Bore and stroke** 3.819″ x 5.039″ **Compression ratio** 17 to 1 **Displacement** 346 cu in **Cranking system** 12 volt **Lubrication** pressure **Air cleaner** dry paper element and centrifugal precleaner with dust evacuation **Oil filter** one full flow and one by-pass filter elements **Oil cooler** engine coolant heat exchanger for engine **Fuel filter** prefilter and two interchangeable felt or paper elements **Muffler** underslung **Cooling medium temperature control** thermostat.

**CHASSIS** **Type** 4-wheel drive **Serial No** 406 121 10 027194 **Tread width** rear 63.75″ front 63.75″ **Wheel base** 93.75″ **Center of gravity** (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 56.3″ Vertical distance above roadway 34.84″ Horizontal distance from center of rear wheel tread 0″ to the right/left **Hydraulic control system** direct engine drive **Transmission** selective gear fixed ratio synchronized transmission **Advertised speeds mph** first 2.4 second 3.0 third 4.3 fourth 5.4 fifth 7.7 sixth 9.7 seventh 13.9 eighth 17.5 ninth 21.0 tenth 26.5 eleventh 34.6 twelfth 46.0 reverse 3.0, 3.8, 5.4, 6.8 **Clutch** single dry plate hydraulically operated by foot pedal **Brakes** dry disc, power assisted, operated by foot pedal **Steering** hydraulic power assist **Turning radius** (on concrete surface without brake) right 189.7″ left 196″ **Turning space diameter** (on concrete surface without brake) right 417″ left 430″ **Power take-off** 540 rpm at 2221 engine rpm and 1000 rpm at 2253 engine rpm

**REPAIRS AND ADJUSTMENTS:** No repairs or adjustments.

**REMARKS:** All test results were determined from observed data obtained in accordance with SAE and ASAE test code or official Nebraska test procedure. Temperature at injection pump return was 156°F. Six gears were chosen up to 15 mph. All drawbar pulls were made from the trailer hitch point.

We, the undersigned, certify that this is a true and correct report of official Tractor Test **1211.**

LOUIS I. LEVITICUS
Engineer-in-Charge

G. W. STEINBRUEGGE, Chairman
W. E. SPLINTER
D. E. LANE
Board of Tractor Test Engineers

**The Agricultural Experiment Station**
**Institute of Agriculture and Natural Resources**
**University of Nebraska–Lincoln**
**H. W. Ottoson, Director**

# EXPLANATION OF TEST REPORT

## GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories may be disconnected only when the means for disconnecting can be reached from the operator station. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

## PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

## POWER TAKE-OFF PERFORMANCE

**Maximum Power and Fuel Consumption.** The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

**Varying Power and Fuel Consumption.** Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, ½ of the 85% torque; maximum power, ¼ and ¾ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general use.

## DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests.

**Varying Power and Fuel Consumption With Ballast.** The varying power runs are made to show the effects of speed-control devices (engine, governor, automatic transmission, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 4 different runs as follows: (1) as near to the pull at maximum power as possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; (3) 50% of the pull at maximum power; and (4) maintaining the same load and travel speed as in (3) by shifting to a higher gear and reducing the engine rpm.

**Maximum Power with Ballast.** Maximum power is measured on straight level sections of the test course. Data are shown for not more than 6 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe limit for the test course. The manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. The maximum safe speed for the Nebraska Test Course has been set at 15 mph. The slip limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

**Varying Drawbar Pull and Travel Speed with Ballast.** Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

## SOUND MEASUREMENT

Sound is recorded during each of the Varying Power and Fuel Consumption runs as the tractor travels on a straight section of the test course. The dB(A) sound level is obtained with the microphone located near the right ear of the operator. Bystander sound readings are taken with the microphone placed 25 feet from the line of travel of the tractor.

**An increase of 10 dB(A) will approximately double the loudness to the human ear.**

For additional information about the **Nebraska Tractor Tests** write to the **Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska** 68583.


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